federal register

THURSDAY, JULY 31, 1975

WASHINGTON, D.C.

Volume 40 ■ Number 148

PART III

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

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COKE OVEN EMISSIONS

Proposed Standards for Exposure

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

[29 CFR Part 1910]

[Docket No. H-017]

EXPOSURE TO COKE OVEN EMISSIONS

Proposed Standard

Pursuant to sections 6(b) and 8(c) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1599; 29 U.S.C. 655, 657), and 29 CFR Part 1911, it is proposed to amend Part 1910 of Title 29 Code of Federal Regulations by adding a new occupational safety and health standard for exposure to coke oven emissions as § 1910.1029.

The accompanying document is a proposal, required by section 6(b) of the Act as a step in the administrative rulemaking process. The notice requests the submission of written comments, data, and arguments from any interested persons on a variety of issues. In addition, an informal hearing has been scheduled to provide an additional opportunity for discussion of the issues. After the hearing, OSHA will issue a final standard based on the full record of the evidence.

The proposed standard contains a requirement limiting employee exposure to an 8-hour time-weighted average concentration based on a 40-hour week of respirable particulates of 0.3 milligrams per cubic meter of air (0.3 mg/m³). The proposal also provides for employee exposure measurements, method of compliance, personal protective equipment and clothing, training, medical surveillance, and recordkeeping.

The issues raised in the proposal include, among others, the following:

1. The selection of the substance to be regulated, namely respirable particulates, and the technological feasibility of compliance with the permissible exposure limit of 0.3 mg/m³. In addition, the alternative substances considered including benzo(a)pyrene (B(a)P) and total coal tar pitch volatiles (CTPV) and the technological feasibility of compliance under these alternatives should be considered.

2. The application of the concepts of latency periods and threshold levels for carcinogens in the context of setting a limit for employee exposure to a carcinogenic substance or substances;

3. The selection of an appropriate level of any of the above indicator substances;

4. The provisions for, among other things, employee exposure measurements, compliance procedures, medical surveillance, and protective equipment and clothing, hygiene facilities, and recordkeeping;

5. The determination as to what protection can or should be afforded employees who are removed from their present jobs as a result of the medical surveillance program;

6. The impact of overtime on determining the permissible exposure limit; and

7. The environmental and inflationary impact of this proposal.

In the development of this proposal, the Occupational Safety and Health Administration (OSHA) has considered recommendations obtained in the document "Criteria for a Recommended Standard * * * Occupational Exposure to Coke Oven Emissions" which was developed for the Secretary of Labor by the National Institute for Occupational Safety and Health (NIOSH), Department of Health, Education, and Welfare. Further, OSHA has considered the detailed record compiled by the Standards Advisory Committee on Coke Oven Emissions, with particular emphasis on the recommended standard and supporting documentation contained in the Committee's report which was submitted to the Secretary on May 24, 1975.

Signed at Washington, D.C. this 24th day of July, 1975.

JOHN T. DUNLOP,
Secretary of Labor

I. PERTINENT STATUTORY BACKGROUND

The Occupational Safety and Health Act of 1970 provides, among other things, that the Secretary of Labor:

> * * * in promulgating standards dealing with toxic materials or harmful physical agents under this subsection, shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life.
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> In addition to the attainment of the highest degree of health and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws.

While standard is to be based on the best available evidence, the legislative history makes it clear that "it is not intended that the Secretary be paralyzed by debate surrounding diverse medical opinion. H.R. 91-1291, p. 18."

In addition to the basic statutory provision outlining the criteria for setting standards, the Act also provides that standards shall include, where appropriate, labels or other forms of warnings to apprise employees of hazards to which they are exposed. Other items to be included are provisions for suitable protective equipment, control procedures, monitoring and measuring employee exposure, employee observation and access to the results of such monitoring, the type and frequency of medical examinations to be made available at no cost to the employee, and recordkeeping. The proposal reflects these statutory criteria.

II. BACKGROUND

Coke is the porous, cellular material which results from the destructive distillation of coal. It is used in steelmaking as a fuel and reducing agent in blast furnace operations, and in foundries as a cupola fuel. Of the approximately 65 million tons of coke produced annually in the United States, 92 percent is blast furnace coke and 8 percent is foundry coke. Two basic processes are utilized in the production of coke, one that removes vapors and other by-products from the coking process and one that does not. No new process is sufficiently advanced to be considered as a replacement for currently utilized coke oven technology. Indeed, two thirds of the ovens in use at this time are 20 or more years old and will continue to be used for many more years.

Moreover, coke presently is in short supply in the United States. However, several new coke oven batteries are under construction and over the next few years it is anticipated that 3 to 4 million tons of new coke making capacity will be added each year. In addition, while the demand for coal chemicals has declined in recent years in favor of petrochemicals, the situation may well be reversed as petroleum supplies become increasingly scarce.

A. BEEHIVE OVEN COKE PRODUCTION

Prior to 1910, the use of beehive ovens predominated in the production of coke. By 1910, there were 548 beehive coke plants with over 100,000 ovens. As by-product coke ovens became established, the number of beehive coke ovens declined steadily, except for a brief increase during World War II and the Korean War.

The name "beehive" accurately describes the shape of the oven. The coal is dropped into the opening or "trunnel head" at the top of the oven from the "larry car." The pile of coal is leveled either by machine or by hand to assure uniform coking. The door on the side of the oven is almost completely bricked up following leveling to provide proper heating of the coal. At the end of the coking cycle, the brickwork on the door is removed and the coke is "watered out" prior to removal from the oven by machine or hand.

B. BY-PRODUCT COKE PRODUCTION

The first by-product coke ovens in the United States began operation in the 1890's. Industrial expansion resulted in a continued increase in the number of by-product coke plants in the early 1900's. Additional coke and by-product capacity necessitated by the need for coke oven gas, by gas utilities resulted in further expansion of the industry during the 1920's. The depression of the 1930's halted construction of new plants and decreased the number of ovens in use. Construction resumed after the outbreak of World War II and continued into the 1950's, with the number of operating ovens peaking in 1958. Since then the number of plants and ovens has declined slowly, dropping from 66 by-product coke plants in 1966, to 64 in 1968, and 61 in 1973. However, with the increasing demand for coke, production capacity is expected to rise to meet this increased demand.

A by-product coke battery consists of 10 to 100 ovens made up of heating chambers, coking chambers, and regenerative chambers. Heating and coking chambers alternate with each other so that there is a heating chamber on either side of a coking chamber containing a series of flues; the regenerative chambers are located underneath. Oven size varies considerably. Present day ovens measure from 3 to 6 meters (10 to 20 feet) in height, 11 to 15 meters (37 to 50 feet) in length, and 42.5 to 50 centimeters (17 to 20 inches) in width. Ovens with the larger dimensions are generally of more recent construction.

The coking cycle begins with the introduction of coal into the coke oven. This procedure, called "charging," is carried out by means of a mechanical "larry car" which operates on rails on the top of the battery. The larry car receives a load of coal from the coal bunker at the end of the battery in a number of coal hoppers which correspond to the number of charging holes, usually either 3 or 4. The car then moves down the battery to the oven to be charged. The lids on the oven charging holes are removed, the larry car is positioned over the holes, and the hoppers are emptied. During the charge, the oven is placed under steam aspiration by the use of steam jets located in the standpipes connecting the by-product gas collector main with the oven. This operation, called "charging on the main," is designed to limit the escape of gases from the oven during the charging process so that they can be collected for processing in the by-product plant. After the charge is completed the lids are replaced and the aspiration system shut off.

The "coking time," the time required to produce coke from coal, is governed by numerous factors including the condition and design of the oven heating system, width of the coking chamber, and the nature of the coals being coked. A coking time is selected which will give the coke adjacent to the chamber walls a temperature of 1046 C (1900 F) to 1100 C (2000 F) when the coal has been coked all the way through to the center. Actual heating chamber flue temperatures should not exceed 1438 C (2600 F) to 1550 C (2800 F), the maximum safe temperature for the refractory brick. The coking time for blast furnace coke varies from 16 to 20 hours, averaging 17 to 18 hours. Coking times for foundry coke are longer than for blast furnace coke because coke of higher purity is required for foundry operations.

When the coal is coked the doors on each side of the oven are removed and the coke is pushed. A large mechanically operated ram attached to a pusher machine moves the coke out the opposite side of the oven, called the "coke-side," through the "coke-guide" attached to the door machine and into a railroad car called the "hot car" or "quench car." The quench car moves down the battery to a "quench tower" where the hot coke is cooled with water. The quenched coke is then dumped onto the coke wharf from which it is conveyed to the screening station for sizing then to the blast furnace or removed for whatever other purpose it is used. When the doors on the oven are replaced, the oven is ready to be charged again.

C. PRODUCTS OF COKE PRODUCTION

The coking process involves many complex reactions which can be analysed in three basic steps. First, there is a breakdown of coal at temperatures below 700 C (1296 F) to primary products consisting of water, carbon monoxide, carbon dioxide, hydrogen sulfide, olefins, paraffins, hydroaromatics, phenolic and nitrogen-containing compounds. Second, thermal reactions of the primary products occur as they pass through the hot coke, along the heated oven walls, and through the hot free spaces in the oven above 700 C (1296 F) resulting in the formation of aromatic hydrocarbons, methane, and the evolution of large amounts of hydrogen, and decomposition of nitrogen-containing compounds, hydrogen cyanide, pyridine bases, ammonia and nitrogen. Third, production of the hard coke occurs by the progressive removal of hydrogen.

Twenty to thirty-five percent by weight of the initial coke charge is evolved as vapors and gases and are collected in by-product coke production. One ton of coal yields the following amounts of coke and coal chemicals:

- Blast Furnace Coke—545–635kg (1,200–1,400 lb.)
- Coke Breeze (Large coke particulates)—45–90kg (100–200 lb.)
- Coke Oven Gas—285–345m³ (9,500–11,500 ft³)
- Tar—30–45 l (8–12 gal.)
- Ammonia Sulfate—9–14kg (20–30 lb.)
- Ammonia Liquor—55–135 l (15–35 gal.)
- Light Oil—10–15 l (2.5–4 gal.)

The coke oven gas contains numerous fixed gases, i.e., those which are gases at 16 C (60 F) and 760 mm pressure. The fixed gases are hydrogen, methane, ethane, carbon monoxide, carbon dioxide, ethylene, propylene, britylene, acetylene, hydrogen sulfide, ammonia, oxygen, and nitrogen. The ammonia liquor is an aqueous solution of a number of ammonium salts condensed from the gas. The tar is black viscous liquid which condenses from the gas in the collector main. It is the source of pyridine, tar acids, naphthalene, creosote oil, and coal tar pitch. The light oil fraction is a yellow-brown liquid of varying composition. Principal products recovered from the light oil are benzene, xylene, toluene, and solvent naphthas.

D. HISTORY OF REGULATION

As we point out more fully below, emissions from coke ovens pose a significant risk of cancer to the exposed working population. Occupational cancer resulting from exposure to the products of combustion or distillation of coal was first noted in 1775 and officially recognized in England when cancers or skin lesions resulting from the handling or use of "pitch, tar and tarry compounds" were listed in 1907 as compensable diseases under the Workmen's Compensation Schedule. In 1920, these conditions were added to the list of notifiable diseases in the Factories Act.

In the United States, the American Conference of Governmental Industrial Hygienists (ACGIH) adopted in 1967 an 8-hour time-weighted average of 0.2 mg/m³ coal tar pitch volatiles (CTPV), defined as the benzene soluble fraction of the total particulates. The limit was established to minimize exposure to the carcinogenic components of CTPV. In 1969, the Secretary of Labor promulgated the 1968 Threshold Limit Values of the ACGIH, including the CTPV limit of 0.2 mg/m³, under the Walsh-Healey Public Contracts Act (41 U.S.C. 35 et seq.) (34 FR 788–796).

These standards were subsequently adopted as established Federal standards under section 6(a) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593; 29 U.S.C. 655). The applicability of the CTPV standard to coke oven emissions was challenged in a petition filed with the Department of Labor (DOL) on 8 June 1971, by the American Iron and Steel Institute (AISI). In addition to revocation of the existing standard, AISI requested appointment of an advisory committee under sections 6 and 7 of the Act (29 U.S.C. 655, 656) and the establishment of the use of respirators as an interim control measure. Following the receipt of the AISI petition, the United Steelworkers of America, on 12 July 1971 requested DOL to develop stringent standards for exposure to CTPV in coke ovens, refineries, and smelters.

On 9 September 1971 (36 FR 18129), DOL denied the petitions insofar as they related to the commencement of a standard-setting proceeding, pending further research by NIOSH. The notice affirmed the propriety of the promulgation of the CTPV standard and stated that coke oven operators could comply with that standard. To provide guidance as to the methods of compliance, the notice set out certain protective measures that should be adopted pending the implementation of feasible engineering controls. These included the use of respirators, protective skin creams, and medical examinations. The development and implementation of engineering controls to reduce employee exposure to CTPV was expected to continue pending completion of the NIOSH research and any subsequent rulemaking proceedings.

In February of 1973, NIOSH published the document "Criteria for a Recommended Standard * * * Occupational Exposure to Coke Oven Emissions." Acknowledging the lack of data to establish a safe environmental level for coke oven emissions, the criteria document recommended the use of engineering controls and operating procedures, supplemented by respiratory protection, to reduce employee exposure to coke oven emissions. NIOSH did not recommend a change in the CTPV standard but rather stated that it could be used ". . . both as an index of worker exposure to coke oven emissions and as a measure of the effective-

ness of engineering controls and operating procedures."

In accordance with the Federal Advisory Committee Act (84 Stat. 770, 5 U.S.C. App. I) and section 7(b) of the Act (29 U.S.C. 656), the Assistant Secretary established a Standards Advisory Committee on Coke Oven Emissions. The Committee was chartered ". . . to study the problems of coke oven emissions with respect to the exposure of workers to such emissions in order to prepare recommendations for an effective standard in the assigned area." The Committee held its first meeting in Washington, D.C., on November 6, 1974. During the course of its operation, the Committee scheduled twenty-eight (28) meeting days during which testimony was presented by numerous experts and over 200 exhibits were received. As a result of its deliberations the Committee prepared a recommended standard for employee exposure to coke oven emissions and submitted it to the Secretary on 24 May 1974, for consideration in the development of a proposed standard for exposure to coke oven emissions. The various committee recommendations are discussed in section IV of this notice on the proposed standard.

III. Carcinogenesis of Coke-Oven Emissions

A. Certain General Considerations

Despite the manpower and resources which have been devoted over several decades to the study of cancer, scientists are still far from agreement on the causes, nature, and even definition of cancer. In general, certain theories which are believed to represent some of the most advanced research findings and policy of both national and international cancer experts and agencies have been considered by the Department of Labor in dealing with the problems of occupational exposure to emissions from coke ovens. In such an inquiry, we recognize that we are perhaps operating on the frontiers of knowledge.[1] We however relied upon what we believe to be the best available evidence and interpretations and are prepared to modify our views if future scientific advances show we were in error.

1. *The latency of carcinogenic effect.* In man, as well as in experimental animals, the latency period for chemical carcinogens may well be as long as 15, 20, or even 30 years in man. This means that the disease may undergo a long development before a tumor is actually detected. At that point, it has reached a stage where removal of the worker from the workplace may be of no avail and where treatment may be extremely difficult, if not futile. Prudent policy would therefore seem to indicate that every reasonable measure should be taken to eliminate human exposure to chemical compounds as soon as their carcinogenic nature is identified.

2. *The variability in individual susceptibility in relation to the concept of a threshold.* Cancer development may be influenced by such factors as the differing susceptibility of various body organs. In animal studies it has been found that individual variability in response to carcinogens is great, depending upon factors such as age, sex, hormonal status, diet, and genetic factors. Thus, in the working population, certain groups such as smokers and workers exposed to carcinogens when young, may be more susceptible than other groups.

3. *A "threshold level".* Because of the variability of individual response to carcinogens and other factors, the concept of a "threshold level" may have little applicability on the basis of existing knowledge. Cancer may be a process which can be initiated by the transformation of only one or a few cells; its development may take close to a lifetime to manifest itself; and some individuals may be more susceptible than others. Thus, while a "threshold" exposure level, below which exposure does not cause cancer, may conceivably exist for an individual, susceptible individuals in the working population may have cancer induced by doses so low as to be effectively zero.

These theoretical concepts have a bearing on the coke oven emissions issue, particularly as to the question of the existence, or nonexistence, of a threshold level of carcinogenic effect. A "no-effect" level theoretically may exist, but it has not been demonstrated.[2]

In previous rulemaking proceedings, OSHA has considered these issues and determined that in the absence of evidence to establish a safe level on the basis of present knowledge, employee exposure must be reduced as low as feasible. (See the preambles to the carcinogen standards 29 CFR 1910.1003–1016 (39 FR 3758) and the vinyl chloride standard 29 CFR 1910.1018 (39 FR 35892)). We welcome all views and comments on these subjects as well as the other issues raised by this proposal.

B. Evidence of Carcinogenicity

It has long been recognized that the combustion or distillation products of coal are carcinogenic to humans. Over the past 200 years it has been demonstrated that a variety of industrial populations exposed either to emissions from these processes or to the handling of the products have a special susceptibility to cancer of the lung, skin, and urinary organs (1).

The first observation of cancer from coal products was made in 1775 by Percivall Pott who noted that cancer of the scrotum in London chimney sweeps was peculiar to that occupation (2). For almost 100 years, Pott's observations were looked upon as a medical curiosity and no further attempt was made to further relate cancer incidence to occupation.

In 1873, three cases of scrotal cancer were reported by Volkmann in men handling tar and paraffin recovered from the carbonization of lignite. These cases ". . . agreed to the last detail with the so-called chimney-sweep cancer of the British." (3). Additional reports of unusual skin cancer experience among coal carbonization workers and handlers of various by-products soon appeared (4,5, 6).

Experimental studies on cancer induction further demonstrated the carcinogenicity of materials produced during the destructive distillation of coal, and eventually led to the isolation of the first known chemical carcinogen. In 1915, Yamagiwa and Ichikawa (7) showed that coal tar was carcinogenic for the skin of the rabbit and in 1922, Passey induced skin cancer with an ether extract of chimney soot (8). Following many years of research on the constituents of coal tar distillates many discrete chemicals, potent carcinogens in animals, were isolated, including benzo(a)prene (9). As early as 1892, it was suggested that exposure to coal tar products might be responsible for cancer of internal organs (4), and many investigators during the early 20th century speculated that the increasing rate of lung cancer might be attributed to the increased use of tar and tar products (10,11). Prior to 1936, however, the evidence linking lung cancer to coal tar exposures was limited to single case reports and to the observation by Kennaway that a high proportion of noncutaneous cancers in chimney-sweeps were situated in the respiratory tract and in the alimentary tract above the stomach (12).

1. *Lung cancer.* The first report of unusual lung cancer experience for men engaged in coal carbonization concerned producer gas workers in Japan (13). In 1936, lung cancer was a relatively uncommon disease in Japan, accounting for only 3.1 percent of all malignancies (14). However, there was an extreme high lung cancer rate for gas generator workers which was even more striking in contrast with the experience of other employees at the same steel plant. Not a single lung cancer was noted among the 46 malignant neoplasms observed in the other employees. In the same year that the Japanese reported the lung cancer excess in gas generator workers, Kennaway's survey of death certificates for England and Wales, 1921 to 1932, showed that other coal carbonization and by-product workers had experienced higher than expected lung cancer mortality (15). In this and a later report for 1921 to 1938, the Kennaways reported excess lung cancer mortality for gas producer-men, chimney-sweeps, and several categories of gas works employees (16). The excess indicated for "gas stokers and coke oven chargers" was approximately threefold. Doll, in a study of gas retort pen-

[1] "I.U.D., vs Hodgson," 499 F 2d 467, 474 (DC Cir. 1974).

[2] This principle has been adopted by the Secretary of the Department of Health, Education, and Welfare, Casper Weinberger, in a letter dated June 14, 1974, to Congress objecting to proposed legislation amending the "anti-cancer" clauses of the Food, Drug and Cosmetic Act: "At present, the Department of Health, Education, and Welfare lacks the scientific information necessary to establish no-effect levels for carcinogenic substances in animals in general and in man in particular * * *"

sioners in 1952, observed an 81 percent excess of lung cancer deaths in comparison with the general population (17). More recently, he has confirmed a high risk for British gas workers and has noted differential rates by type of retort and by level of exposure (18).

Most recently, Lloyd and Redmond have shown that men employed at coke ovens have an excess risk of lung cancer (19). They note that men employed five (5) or more years at the top of these ovens have experienced ten (10) times the lung cancer mortality rate of other steelworkers. Men who had a mixture of both top and side oven experience were found to have 3.2 times the expected lung cancer mortality. Men with five (5) or more years of only side oven experience were found to have 2.1 times the expected lung cancer mortality. Researchers have disagreed on the cancer incidence rate for persons exposed to coke oven and related emissions.

Although Reid and Buck concluded from a mortality study of British coke plant workers that "* * * the mortality in the coking industry from cancer in general and cancer of the lung in particular, is not as excessive as had been feared, and may in fact be negligible." (20) Christian, reported a 24-fold excess of lung cancer for coke workers at a large public utility (21). Review of these studies shows that the apparent discrepancies between these findings may be explained in large part by differences in the definition of the study populations and the comparison groups, and by the fact that the extremely high risk is limited to a relatively small proportion of the coke oven workers.

2. *Skin cancer.* The first American cases of skin cancer associated with exposure to coal tar products were carbon workers reported by Lueke in 1907 (22). In the same year, the British included in the Workmen's Compensation Schedule "* * * scrotal epithelioma occurring in chimney sweeps and epitheliomatous cancer or ulceration of the skin occurring in chimney sweeps and epitheliomatous cancer or ulceration of the skin occurring in the handling or use of pitch, tar, and tarry compounds * * *" and later made these diseases reportable under the Factories Act. The extent of the skin cancer problem among coal tar workers and the variation in incidence within occupation are reported in a comprehensive review by Henry (23). For the period 1900 to 1943, eighty-four (84) cases of epitheliomatous ulceration or cancer of the skin, including forty (40) scrotal cancers, were reported for British coke oven workers. Among men with prior coke oven employment eleven (11) fatal scrotal cancers were reported.

In contrast, of fifteen (15) skin cancer deaths reported in a recent survey of United States steelworkers none had been reported in workers employed at the coke oven (24). Because of the relatively low incidence rate of this disease and the high survival rate for skin cancer, it is impossible to determine whether the lower rate of skin cancer deaths among American coke oven workers is a reflection of differential response, differences in medical care, or other factors such as sampling variations.

3. *Cancer of the urinary system.* Workers exposed to emissions from coke ovens and gas retorts also show an excess of mortality from urinary system cancers. In their review of bladder cancer deaths for 1921 to 1928, Henry, et al., reports greater-than-expected mortality for nine occupational groups exhibiting an excess of 50% or greater (25). Five of the groups were among the "coal tar" occupations. Their finding of a higher rate for gas retort workers has since been verified by Doll, et al. (18). Bruusgaard (26) and Batye (27) also have reported an excess of bladder cancers in retort house workers.

Data on urinary cancer excess is not specific enough to detail its extent by anatomic site and by type of exposure. The bladder cancer findings of Henry, et al. (25), suggest a greater level of risk for by-product workers than for men engaged in the carbonization process. Unfortunately this group cannot be separated to obtain an estimate for coke oven workers. No excess of bladder cancer deaths has been observed to date in the United States coke plant workers. Redmond, however, has noted a seven-fold risk of kidney cancer mortality for these workers (19). While this excess is based on a small number of cases, kidney cancer usually is a rare form of cancer in our society.

On the basis of the information accumulated to date, it is clear that an agent or agents emitted or produced during combustion or destructive distillation of coal results in the development of lung, skin, and urinary system cancers among those exposed to such emissions.

IV. The Proposal

The following section discusses and analyzes the significant issues of the proposed standard for occupational exposure to coke oven emissions. Because of the nature of the emissions to be regulated and the lack of information as to the specific causal agent, it is important to discuss in some detail at the outset of the description of the proposal, the selection of the substance to be regulated as well as a general discussion of the technical feasibility of compliance with the permissible exposure limit. Comments and information at the hearing are requested on all of the alternatives discussed in this section in particular with regard to their use in regulating exposure to coke oven emissions and their technological feasibility.

A. Selection of the Substance to be Regulated and Proposed Levels

The determination of the precise component or components of coke oven emissions which are responsible for the excess of lung and other cancer in coke oven workers has not yet been made. This by itself makes the attempt to set a safe exposure limit quite difficult.

Several compounds, the polynuclear aromatic hydrocarbons (PNA) in particular, present in the products of combustion or distillation of organic matter such as coal have been shown to be carcinogenic.

1. *The Present coal tar pitch volatile standard.* The existing standard of 0.2 mg/m³ benzene-soluble fraction of coal tar pitch volatiles (CTPV) is a nonspecific measurement, as a wide variety of substances which may or may not be carcinogenic are present. The composition of CTPV may vary depending on various factors such as coking procedures and the original coals used. These substances may include polynuclear aromatic hydrocarbons (PNA), aliphatic hydrocarbons, and amines. This value of 0.2 mg/m³ for CTPV was adopted by the American Conference of Governmental Industrial Hygienists in 1967 as a level that "should minimize exposure" to the carcinogens present, but no definite statement presently can be made as to its relationship to a safe exposure. Consequently, the chemical complexity of coke oven emissions may limit the usefulness of CTPV samples collected at coke ovens. Problems associated with the sampling and analytical method further reduce the value of the CTPV sampling. For example, the silver membrane upon which the sample is collected may break during handling resulting in false measurement. The use of benzene in the extraction process has health problems of its own since benzene itself is toxic and its use should be restricted.

2. *An alternative CTPV proposal based on Redmond data.* The suggestion has been made that the level of 0.56 mg/m³ CTPV is a safe exposure. This is based on a study by Dr. Carol Redmond and associates of the University of Pittsburgh Graduate School of Public Health (29). This study attempted to correlate mortality data with exposure data. Coal tar pitch volatile data by job category collected in Allegheny County, Pa. after 1967 was used. Mortality data was for coke oven workers employed prior to that year. Cumulative exposure over time was calculated based on the number of years worked at a particular job and the CTPV levels measured for that job. The point in time in which cancer developed was noted and the exposure up to that time calculated. This treatment of the data yielded a figure of 0.56 mg/m³ CTPV as a level below which cancers were not seen. This analysis has several inherent problems that dictate caution in relying on the results. The mortality data and exposure data were from different times. Levels of exposure measured after 1967 cannot be assumed to represent the levels to which the men in the study were exposed. There may be therefore, no relationship between the two data sets involved.[8] Moreover, the model of cancer development used in this study was the "instantaneous cancer model" which assumes that the total accumulated dose of the carcinogen was necessary for the development of the cancer. It is equally conceivable that the actual carcinogenic dose was well below the total accumulated and that the remaining dose accumulated was extraneous. These problems were not reflected in the study.

3. *The cyclohexane soluble proposal.* The use of cyclohexane as a replacement for benzene in the analysis of particulates has been suggested by some individuals (32,33,34). Cyclohexane dissolves a narrower spectrum of compounds than benzene thereby eliminating some materials not considered significant (e.g., aliphatic hydrocarbons), and is less toxic than benzene. There is no epidemiological data, however, upon which a level of exposure to cyclohexane soluble material can be set at the present time.

4. *The benzo(a)pyrene proposal.* The Standards Advisory Committee on Coke Oven Emissions recommended a standard for exposure to benzo(a)pyrene (B(a)P) one of the PNA, which has been identified in coke oven emissions. The committee recommended that employees not be exposed to B(a)P in excess of 0.2 micrograms per cubic meter of air (ug/m³) calculated on an eight-hour time-weighted average basis. This level was selected as representative of background or ambient levels of B(a)P in urban air as determined by the National Air Sampling Network of the Environmental Protection Agency.

B(a)P has induced lung tumors experimentally when a particulate carrier is used to ensure extended retention (35,36, 37). In other words, the successful induction of lung tumors with B(a)P occurs in the presence of some physical factor which keeps the carcinogen in contact with the tissue for a prolonged period. It has been suggested that the carcinogenic effect occurs as a result of adherence of the PNA to the particle surface from which it is slowly released into the tissue. More prolonged and constant action is thus achieved (38,39,40).

Rate of clearance of the carcinogen also plays a role. Thus, smaller particles are eliminated from the lungs more slowly thus allowing longer contact time. Interference with ciliary activity in the respiratory tract will also inhibit clearance of inhaled material as demonstrated in studies by Laskin et al. (41), who induced lung tumors in rats with B(a)P following exposure to sulfur dioxide (SO_2), a known pulmonary irritant.

There is no environment in which B(a)P is present without other pollutants also being present. In the coke oven environment, there are a myriad of other substances including other carcinogenic hydrocarbons as well as B(a)P.

Development of lung cancer as a result of the synergistic action of two or more of these substances is a possibility. However, the carcinogenic potency of complex mixtures containing B(a)P may be accounted for to a large extent by its content of B(a)P (42). For the reasons below, we believe that respirable particulates will provide a better measure of employee exposure to coke oven emissions.

[2] These factors were recognized by the author of the study in testimony before the Standards Advisory Committee on Coke Oven Emissions and reiterated by Dr. J. William Lloyd, a member of the Committee.

5. *The respirable particulate proposal.* The importance of the role of particulate matter in inhalation of PNA has been established (43). PNA occur in the air primarily as adsorbed compounds on particulates (32). Particle size determines the extent to which the particle will penetrate the tracheobronchial tree. Models of particle deposition in the lung have been developed to provide an index for determining the potential hazard from inhaled particulates (44, 45). The Task Group on Lung Dynamics of the International Commission on Radiological Protection proposed a model for deposition and retention based on nose breathing (44). Deposition was based on particle mass median diameter (MMD). At the 1450 cc tidal volume, and a respiratory frequency of 15 cycles per minute, 55–65% of particles less than 0.1 micron MMD will be deposited in the deep, nonciliated region of the lung. Limitations of this model, and all mathematical formulations, include assumption of equal and constant flowrates, constant branching angles, and constant dimensions during respiratory excursions (46).

Data presently available is not sufficient to indicate which specific components of coke oven emissions are responsible for the lung cancer, and at what level such emissions should be regulated. Available information does indicate that particulates are the means by which the polynuclear aromatic hydrocarbons (PNA) gain entry to the respiratory tract. In fact, respirable dust standards have been set by several organizations including the Nuclear Regulatory Commission, formerly the Atomic Energy Commission (46) and ACGIH whose standards have been adopted by OSHA, 29 CFR 1910.1000 Table Z–3. The use of respirable particulates will assure that the samples collected will include those compounds believed to be the lung carcinogens. The Standards Advisory Committee on Coke Oven Emissions recommended that measurements for respirable particulates be carried out every six months as part of the regular employee exposure monitoring program.

The level of respirable particulates in the proposal is 0.3 milligrams of respirable particulates per cubic meter of air. This level is based on a correlation of B(a)P in respirable particulate levels on the coke oven topside with levels of B(a)P in urban air (0.2 ug/m³). This correlation was derived from data presented to the Advisory Committee and included in its report (47, 48). Measurement of respirable particulates can be accomplished with relative ease and will give a good index of the hazard from coke oven emissions. In light of relatively low ambient levels of respirable particulates which have been found in urban environments, it is not anticipated that the background levels will interfere with the measurement of there spirable particulates contributed by coke oven emissions in the work environment.

Because of the relationship of PNA to particulates, semi annual analysis of samples for benzo(a)pyrene (B(a)P) is required as an additional index for evaluating the carcinogenic potential of exposure to coke oven emissions. Section (8)(c)(1) of the Act authorizes the Secretary to require employers to make, keep, and preserve such records as may be necessary for developing information on the causes and prevention of occupational illnesses. The measurement of B(a)P and the recording of these measurements will assist in performing this function with respect to the carcinogenic hazard of coke oven emissions.

B. EFFECTS OF OVERTIME ON EXPOSURE

The permissible exposure limit is based on an eight-hour time-weighted-average (TWA) concentration. OSHA recognizes, however, that work shifts can extend beyond the regular eight-hour period as the result of overtime or other alterations of the work schedule. This extension of work time also extends the time during which the employee is exposed. The effects of this additional exposure time must be considered in arriving at a level of exposure.

For the purpose of calculating an exposure level, the relationship of concentration and time of exposure has been assumed to be linear. As the exposure time increases, the factor of concentration multiplied by time (C x T) should remain constant.

It is believed that by equating exposure with the eight-hour TWA, reasonable assurance of maintaining a safe exposure level is retained.

C. METHODS OF COMPLIANCE AND TECHNOLOGICAL FEASIBILITY

1. *Compliance program.* The proposed standard requires that employers immediately institute feasible engineering controls to reduce employee exposure to coke oven emissions where that exposure exceeds the permissible exposure limit. In workplaces where controls that can be instituted immediately will not reduce exposure to the permissible limit, they must nonetheless be implemented to reduce exposure to the lowest practicable level, and supplemented by the use of work practice controls. This is because of the problems generally associated with the use of work practice controls, which are effective only when strong supervisory control is maintained.

Respirators can be used only where the feasible engineering and work practice controls are insufficient to reduce exposures to or below the permissible exposure limit because of the problems associated with the use of respirators. Respirators are capable of providing good protection only if they are properly selected for the concentrations of airborne contaminants present, properly fitted to the employee, worn by the employee, and replaced when they have ceased to provide protection. While it is theoretically possible for all of these conditions to be met, often they are not, and as a consequence, the protection of employees by respirators can only be used where engineering and work practice controls cannot reduce exposure to the permissible exposure limit.

Where, as stated above, compliance with this standard cannot be achieved immediately through the institution of engineering and work practice controls, they must nevertheless be used to control exposure to the lowest practicable level. In addition, a written program must be established and implemented to reduce exposures to the permissible exposure limit by means of engineering controls and supplementary work practices. This program, to be developed by the employer, must include specific items similar to those recommended by the Advisory Committee. Most importantly, the plan must include a schedule for implementation of the compliance program where the controls cannot be instituted immediately. The standard provides that this program must be furnished upon request to the Secretary and the Director of NIOSH and must be available at the worksite not only to those government officials, but also to the employee representative. The employer is required to review and update the plan at least every 6 months to reflect the current status of the program.

The Committee recommendations contain a specific administrative procedure for OSHA to implement as part of the standard in order to assure the adequacy of these plans. It included the issuance of an abatement order by the Secretary following an administrative procedure involving possible pre-approval inspections and a hearing with participation by interested parties, including the employer and employees. While the eventual development of such a program is possible, it is believed that its inclusion in a standard regulating a specific hazard is inappropriate since it really is applicable not only to OSHA's compliance operations in the area of coke oven emissions, but also to other standards with similar requirements for a compliance program.

1. *Technological feasibility.* As part of its recommended standard, the Advisory Committee included detailed requirements mandating specific engineering and work practice controls. OSHA prefers, however, not to include detailed specifications on possible methods of compliance in the standard in order not to limit the development of new technology or necessitate frequent revision of the standard. However, in order to provide some information and guidance as to the technology currently available and its application to existing and rehabilitated or new batteries, a list of some engineering controls and work practices is included as Appendix B to the standard.

On the basis of the record compiled by the Advisory Committee and OSHA's current compliance activity under the existing standard, it is apparent that it is technologically feasible to reduce employee exposure to or below the permissible exposure limit through the implementation of engineering, work practice, and personal protective controls. Information is requested as part of the proceeding as to the feasibility of reaching the permissible exposure limit solely through the use of engineering controls and supplementary work practices, including the question of retrofitting existing coke oven batteries with new technology. In addition, information is sought as to any specific difficulties associated with the supplementary work practices and personal protective controls which might affect the feasibility of reducing exposure to the permissible exposure limit.

Finally, it is OSHA's opinion that the application of well-designed emission control technology will not necessarily preclude the attainment of the level of worker health protection provided by this proposal.

D. SCOPE AND APPLICATION

This standard is applicable to the process of the destructive distillation of coal for the production of coke and it is intended to cover employee exposure to the emissions which are present during this process. The work environment to be included therefore centers on the operation where this process occurs i.e., the coke oven. Since the operation to be regulated is conducted in the open environment, however, it is not possible to define with certainty the confines of the process and hence the extent of the emissions. Therefore, the scope of the standard provides for flexibility in determining the area where employees may be exposed while at the same time limiting its scope to that portion of the employer's operation where coke is being produced.

Another aspect of the applicability of this standard is its relationship to the existing standard for coal tar pitch volatiles in 29 CFR 1910.1000 Table Z–1. This proposal is not intended to alter the applicability of the existing standard to those places of employment where employees are exposed to coal tar pitch volatiles such as the aluminum smelting industry. The need for regulating exposure to coke oven emissions under a separate standard reflects the different process involved that results in employee exposure to the volatile matter released by the coal and not primarily to that released from a by-product of the destructive distillation of coal such as coal tar pitch. In addition, evidence is available to document an increased cancer risk from exposure to coke oven emissions as a separate entity and, therefore, requires that the standard, to be effective, focus on that operation and the type of exposure to be controlled in order to assure employee protection. Therefore, the proposed standard, and not the CTPV standard, would apply to coke oven emissions.

E. REGULATED AREA

The proposal requires that regulated areas be established, that access be limited to authorized persons, and that a roster of persons authorized to enter be made daily and maintained for at least 40 years or for the duration of the employment plus 20 years, whichever is longer. One purpose of establishing regulated areas is to limit the exposure to as few people as possible. In addition, by designating certain areas in the coking operations as regulated areas regardless of the exposure limit, this section assists in defining the scope of the standard. It also serves as the mechanism for instituting requirements such as medical surveillance, training, and information such as the location of signs.

F. EXPOSURE MEASUREMENT

Under the provisions of the proposed standard, the employer would be required to monitor each workplace involved in the coking operation to measure the exposure of the employees to coke oven emissions. Actual measurement of airborne concentrations of coke oven emissions would be required. This is the only reliable method by which exposure can be determined, as the coking operations result in the continuous evolution of particulate matter into the air.

Measurements which reveal levels of coke oven emissions below the permissible exposure limit reduce the monitoring requirement from monthly to quarterly. Quarterly monitoring of employee exposure is required as the carcinogenic nature of the emissions and the variability of the coking process itself dictate that monitoring be done regularly to ensure that the employee's exposure remains below the permissible limit.

Where the initial measurements reveal levels of coke oven emissions to be over the permissible exposure limit, monthly monitoring is required. Monthly measurements would be required because OSHA believes that exposure above the permissible exposure limit presents a serious hazard to the employee. Monthly measurement would be required even if the employees routinely wear respirators. However, where two consecutive monthly measurements are below the permissible exposure limit, quarterly monitoring would be applicable.

The results of the exposure measurement program would determine further action to be taken by the employer. In addition to monthly monitoring, measurement of exposure above the permissible exposure limit would require the employer to institute engineering and work practice controls to reduce the exposure to below the permissible exposure limit. Areas in which these levels are found would be designated as regulated areas if they are not already specified as such by the proposed standard.

It should be noted that the reduction or termination of monitoring from monthly to quarterly would be effective only as long as there is no change in production, process, or control which could result in new or additional exposure. If such a change increases the exposure over the permissible limit, monthly monitoring must resume.

The proposed standard provides that the employer inform the employees of their exposure levels as determined by the monitoring program. This information is to be provided regardless of what

the level is measured to be. OSHA believes that the employee has the right to know what his or her exposure level is and whether it is above or below the permissible exposure limit. In addition, if the employee's exposure is above the permissible exposure limit, the employer is required to notify the employee of all measures to be taken to reduce the employee's exposure to below the permissible exposure limit.

The monitoring provisions of the proposed standard state that the accuracy of the sampling method must have a confidence level of 95 percent. The term accuracy refers to the difference between the measured value and the time value. It allows for both the random variation of the method (precision) and the difference between the average result of the method and the true value (bias of the method). The required accuracy for concentrations above the permissible exposure limit is 25 percent at a 95 percent level of confidence. This means that in a series of measurements, 95 percent must be within 25 percent of the true value. The required accuracy value allows the use of relatively inexpensive sampling and analytical equipment.

G. RESPIRATORY PROTECTION

When engineering controls and work practices are not sufficient to reduce employee exposure to below the permissible exposure limit, respirators would be required. In addition, provision is made for the use of respirators in other situations, such as during installation of engineering controls or in emergencies.

The proposal requires the employer to select respirators that have been approved by NIOSH. The employer must select the type of respirator to be used from those in the proposed standard.

Two types of respirators are listed in the proposed standard, consistent with the Advisory Committee's report, the air-purifying high efficiency particulate respirator and the power air-purifying high efficiency particulate respirator. The latter is not presently approved by NIOSH or generally available in the United States. It is in the developmental stage in this country and the Committee believed that recommendation of this respirator would speed its development and hasten its availability for general use.

In addition to the two previously mentioned respirators, the NIOSH criteria document recommended the use of Type C positive pressure air-supplied respirators. These respirators have hazards inherent in their use. The air supply hose is a mechanical hazard in an area with a great deal of moving machinery such as a coke oven battery. Also the presence the hose limits the wearer's mobility as it must be connected to a clean air source. OSHA has included air-supplied respirators in the proposal recognizing that problems exist with their use. It may be possible, however, to modify or create an air-supplied respirator that can be adapted for use in some parts of the coke oven operation.

H. PROTECTIVE CLOTHING AND EQUIPMENT

The proposal requires the employer to provide, and assure that employees use, clean protective clothing and equipment such as, but not limited to waterproof, flame and heat resistant full body covering, face shields, or vented goggles, fire-resistant gloves, shoes, and protective helmets. This requirement is intended to prevent the accumulation of coke oven emission dust on the body or street clothes of the employee.

The proposed standard requires the employer to assure that all protective clothing is removed in special change rooms and that contaminated protective clothing is removed from these rooms only in closed, impermeable containers. The employer is responsible for cleaning, laundering, maintenance, and disposal of protective clothing and equipment. The employer is also required to assure that no employee removes contaminated protective clothing from the change rooms, except those employees authorized to do so for the purpose of cleaning, laundering, maintenance, or disposal. In addition, the employer must assure that the person who is charged with laundering or cleaning contaminated protective clothing or equipment is apprised of the harmful effects of exposure to coke oven emissions.

The requirements for cleaning and control of unnecessary exposure to clothing and equipment contaminated with coke oven emissions is in line with the Advisory Committee's recommendations. Because of the increased incidence of lung cancer associated with coke oven emissions, it is necessary to assure that the potential for exposure to the coke oven dust of other persons such as members of the employee's family and employees who clean or launder the clothing is restricted by the proper precautions in handling material contaminated with coke oven emissions.

I. HYGIENE FACILITIES AND PRACTICES

The proposal provides that all employees working in regulated areas must be required to wash hands, face, and forearms before eating, drinking, smoking, or applying cosmetics. In addition employees working in regulated areas are required to shower before leaving at the end of the work shift. This section of the proposed standard also requires that the employer provide for the hygiene facilities such as change rooms and showers in accordance with 29 CFR 1910.141. Because the requirement for the number of lavatories for industrial employment has been revoked (40 FR 18445) the proposal requires the employer to provide an adequate number of lavatory facilities which shall meet the requirements in 29 CFR 1910.141(d) (2). In addition, the proposal requires the separation between contaminated and uncontaminated areas in locker and shower facilities and the location of lavatory and toilet facilities in such a manner as to prevent access to uncontaminated areas.

In addition, the proposal requires lunchroom facilities which shall be provided with temperature controlled positive-pressure filtered air supply. Finally, smoking, nonfood chewing products, drinking, eating, and the application of cosmetics, are prohibited in regulated areas. The presence of such items is also prohibited in regulated areas.

This section is consistent with the Advisory Committee recommendations and reflects the need for careful hygiene practices where employees are exposed to a carcinogenic agent or agents. In view of the increased incidence of kidney cancer as well as the skin cancer hazard associated with exposure to material containing polynuclear aromatic hydrocarbons, it is important to limit employee exposure to coke oven emissions by ingestion and skin contact as well as inhalation.

J. MEDICAL SURVEILLANCE

Medical surveillance provisions have been included in the proposal to provide for early diagnosis of health effects of exposure to coke oven emissions. This is consistent with the recommendations of the Advisory Committee.

The employer must make medical examinations and tests available to all employees who work in a regulated area for more than 30 days per year. All examinations and procedures must be performed by, or under the supervision of a licensed physician, and provided during the employee's normal working hours without cost to the employee. Examinations are to be performed every six months for employees who are over 45 years of age or have worked at coke ovens for 10 or more years and annually for other employees.

Consistent with the Advisory Committee's recommendations, OSHA has proposed additional medical examinations for a special high risk group of employees, those who are over 45 years of age or have worked at coke ovens for 10 years or more. The proposal has expanded the high risk group as defined by the Advisory Committee to include additional workers believed to be at greater risk of developing lung cancer.

The basic medical examination includes a comprehensive work and medical history, a 14" by 17" posterior-anterior chest x-ray (with UICC classification), pulmonary function tests including forced vital capacity (FVC), baseline weight, and a skin examination. For employees with five or more years coke oven employment or who are 40 years of age or older, a urinary cytologic examination is required. This is to aid in the early detection of kidney cancer, that resulted in a seven-fold excess in coke oven workers as reported by Redmond, et al. (19).

The principal purpose of the chest x-ray and pulmonary function tests is to identify those workers who should not be exposed to coke oven emissions by detecting reduced lung capacity or x-ray changes.

Methods for early detection of lung cancer, chest x-ray and sputum cytology, have a high specificity but low sensitivities. These two procedures are, however, the best screening methods presently available (49). The use of sputum cytology is proposed only for those workers who are 45 years of age or older or who have been employed at coke ovens 10 years or more. This represents a spe-

cial high risk group in which such tests can be useful. Studies by Saccomanno showed a morphological progression to malignant cells over a one to ten year period in cytologic specimens (50). Abnormal cells were present in the sputum before clinical symptoms appeared. Significant symptoms tend to occur only when the disease has reached an advanced stage (51). The cytologic examination is designed to detect not only malignant cells but preferably cells which exhibit abnormal morphology. These may indicate a pre-malignant condition in which case removal of the employee from further exposure or other measures may be taken.

The use of cytologic examinations of sputum in addition to chest x-rays is advisable since individuals with negative x-rays and positive cytologies may have a higher survival rate following surgery (52, 53).

There is disagreement as to the value of sputum cytology, and its inclusion in a medical surveillance protocol has been questioned (54, 55). It is included in the proposed standard, however, as it is felt that it can be of benefit in the high risk group for which it is specified.

Alternative medical examinations may be made available so long as they provide equal assurance of detecting medical conditions relating to exposure to coke oven emissions. The employer may accept a physician's alternative medical examinations provided the employer obtains a statement as to the rationale for the substitution and submits that to the Secretary; and provided the employee is informed of the alternative procedures.

The employer must provide the examining physician with a copy of the standard for coke oven emissions, including appendixes, a description of the employee's duties, a description of any personal protective equipment used by the employee, and information concerning exposure levels to which the employee has been or may be exposed. The employer must also provide any available employee medical history information requested by the physician.

Following the medical examination, the employer must obtain a written opinion from the examining physician stating whether the employee has any medical condition that would place him or her at increased risk to his or her health or that would be aggravated by exposure to coke oven emissions. Additionally, the physician's written opinion must state any recommended limitations upon the employee's exposure or upon the use of protective equipment or respirators. Also, the opinion must state that the employee has been informed of any medical conditions which require further examination or treatment; however, the opinion shall not contain specific medical findings or diagnoses unrelated to occupational exposure. The employer must provide a copy of the physician's opinion to the affected employee.

If, the employer determines that exposure of an employee to coke oven emissions would materially impair the employee's health, it is the responsibility of the employer to remove that employee from exposure. This determination may be based on the physician's written opinion.

The proposal does not contain any provision for job transfer for that employee, nor does it include the Advisory Committee's recommendation that any removal from exposure to coke oven emissions "shall not result in loss of earnings or seniority status to the affected employee."

OSHA recognized that there is great concern over what, if any, protection can or should be afforded employees who are removed from their present jobs as a result of the medical surveillance program. The absence of a job transfer provision such as that recommended by the Committee, it is argued will result in employee refusal to take the medical examinations. On the other hand, there is the question of the extent of the employer's responsibility to guarantee the present income of an employee where, for medical reasons which may or may not be related to any occupational exposure, a physician recommends that action should be taken to avoid either a future health hazard or aggravation of an existing condition. Just as the absence of a transfer provision may result in employee refusal to take a medical examination, so the inclusion of such a provision may represent a disincentive to employers to remove an employee from such exposure because of the impact on the wage and seniority systems currently in existence. Finally, the legal authority of OSHA to require and enforce such a provision has been challenged.

Therefore, although a job transfer provision is not included in the proposal, OSHA hopes that parties to the hearing will address this issue to provide additional information and possible solutions.

K. EMPLOYEE INFORMATION AND TRAINING

Information and training are essential for the protection of employees because an employee can do much to protect himself if he is informed of the nature of the hazards in the workplace. To be effective, however, an employee education system must apprise the employee of the specific hazards associated with the work environment. For this reason, the employer would be required to inform each employee assigned to a regulated area about the nature of coke oven emission-related health problems, the necessity for exposure control, the work practices and engineering controls associated with that employee's job assignment, and the medical and industrial hygiene monitoring programs.

L. SIGNS AND LABELS

Due to the hazardous nature of coke oven emissions, OSHA believes that emphasis should be placed on warning employees and other persons about the dangers of exposure. For this reason, the proposed standard includes a section on signs for regulated areas and areas where the permissible exposure limit is exceeded and labels for containers of contaminated protective clothing.

The signs to be posted at regulated areas inform employees of the carcinogenic hazard of coke oven emissions and alert them to the fact that only persons authorized by the employer should enter the area. Signs posted where the permissible exposure limit is exceeded, and where respiratory protection is required, reiterate the warning of carcinogenicity and advise that respirators are necessary for entry and that such entry is limited to authorized persons.

Containers of contaminated protective clothing are required to be labeled with a statement of the hazard and practices to be avoided in the handling of the clothing. No sign or instruction may contradict or detract from the effect of the warnings, information, or instructions on any sign or label required by this section.

M. RECORDKEEPING

The proposed standard would require employers to keep written records of the following: measurements which indicate whether or not employees are exposed at or above the permissible exposure limit, tests of mechanical ventilation system efficiency (where such systems are used for engineering control), respirator usage, annual training and information sessions, medical examinations and preplacement histories, and rosters of employees who enter regulated areas.

Because symptoms of lung cancer can have a latency period of approximately 20 years or more, records of employee exposure measurements and medical examinations should be retained for at least 40 years to aid physicians in diagnosing potential future illness. For this reason, the recordkeeping provisions of this proposal require the employer to retain exposure measurements for at least 40 years and medical examinations records for at least 40 years, or for the duration of the employee's employment plus 20 years, whichever is longer.

A record of the tests of mechanical ventilation system efficiency is required to be maintained so that the employee can ensure that tests of the system are being made at the required time intervals. Further, the record is useful to the employer since the evaluation of the data obtained in any individual test is needed to compare the most recent test with previous tests to detect any trends that may be occurring.

Section 8(c)(3) of the Act requires, and paragraph (m) of this proposal contains provisions for access to records of exposure measurements by employees, former employees or their representatives, and for access to medical records made pursuant to paragraph (j) by physicians designated by employees or former employees. It should be noted that such access is limited only to the records of determinations, exposure measurements, and medical examinations that are being maintained by the employer in accordance with the record-

keeping requirements; and that the employer is not required to retain or make those records accessible for periods longer than those required in paragraph (m).

N. OBSERVATION OF MONITORING

Section 8(c)(3) of the Act requires that employers provide employees or their representatives with the opportunity to observe monitoring of employee exposures to toxic materials or harmful physical agents. In accordance with this section, the proposed standard contains provisions for such observation. To ensure that this right is meaningful, observers would be entitled to an explanation of the measurement procedure, to observe all steps related to the measurement procedure, and to record the results obtained.

The observer, whether an employee or designated representative, must be provided with and is required to use any personal protective devices required to be worn by employees working in the area that is being monitored, and must comply with all other appplicable safety and health procedures.

V. Conclusions

The Secretary recognizes that many of the matters considered in this proposal are controversial and that, at best, gaps exist in the available scientific evidence. The Secretary does believe that in this case we are dealing with an agent or agents that are carcinogenic in man. Based on the best available evidence, we do not know whether "safe" levels or "no-effect" levels exist for a carcinogen and, if so, what they may be. Therefore, attempts to set "safe" or "no-effect" levels are compromises between the best medical and scientific evidence on the one hand and practical considerations of technological and economic feasibility on the other. These unanswered questions cannot be permitted to hold back the process of setting a standard for protecting workers exposed to coke oven emissions.

Therefore, based on the available evidence and in view of the above considerations, we believe that employee exposures to coke oven emissions must be reduced to the level of 0.3 mg/m³ respirable particulates as set forth in the proposal. We further believe that on the basis of available information, it will be feasible to reduce employee exposure to the permissible exposure limit by use of engineering controls.

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VI. Public Participation

Public participation. Interested persons are invited to comment on the proposed standard. Written data, views, and arguments concerning the proposal must be submitted in quadruplicate to the Docket Officer, Docket No. H–017, Room N–3620, 200 Constitution Avenue, NW., Washington, D.C. 20210, on or before September 15, 1975. Written submissions must clearly identify the provision of the proposal addressed and the position taken with respect to each such provision. The data, views, and arguments will be available for public inspection and copying at the above address. All written submissions received will be made a part of the record of this proceeding.

In order to expedite this rulemaking proceeding and in anticipation of requests for a hearing, we are scheduling an informal public hearing, pursuant to section 6(b) of the Act and 29 CFR Part 1911, to begin on November 4, 1975, in the Departmental Auditorium, Conference Room B, Constitution Avenue between 12th and 14th Sts., NW., Washington, D.C. All aspects of the proposed standard, including its environmental impact will be at issue in the hearing.

In addition to the proposal and its environmental impact, OSHA hereby solicits comments from interested persons regarding the potential inflation impact of the proposed standard. These comments must be submitted in accordance with the requirements of this section. Comments may be directed toward any or all of the following subjects:

(1) Cost impact on consumers, businesses, markets, or Federal, State, or local government;

(2) Effect on the productivity of wage earners, businesses, or government;

(3) Effect on competition;

(4) Effect on supplies of important materials, products or services;

(5) Effect on employment; and

(6) Effect on energy supply or demand.

A preliminary study of the cost impact of the proposal has been prepared, and is available for public inspection and copying at the above address. This study indicates that a full inflation input analysis will be required pursuant to Executive Order 11821 (39 FR 41501, November 27, 1974) and Office of Management and Budget Circular A–107 (January 28, 1975).

Accordingly, it is OSHA's intention to prepare an inflation impact statement and analysis, which will be published on October 4, 1975. Public inspection and comment is invited, and shall be accepted if presented to OSHA on or before December 4, 1975, or until the close of the official hearing record, if such closure occurs after December 4, 1975.

This procedure has been concurred in by the Council on Wage and Price Stability in accordance with OMB Circular A–107 issued pursuant to Executive Order 11821.

Persons desiring to appear at the hearing must file a notice of intention to appear postmarked on or before September 15, 1975, with OSHA Committee Management Office, Docket No. H–017, Room N–3633, U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, D.C. 20210 (Telephone: 202–523–8023). The notices of intention to appear, which will be available for inspection and copying at the above address, must contain the following information:

(1) The name and address of the person to appear;

(2) The capacity in which the person will appear;

(3) The approximate amount of time required for the presentation;

(4) The specific provisions of the proposal that will be addressed;

(5) A detailed statement of the position that will be taken with respect to each provision addressed; and

(6) A detailed statement of the evidence with respect to each such provision proposed to be adduced at the hearing.

OSHA has determined that strict enforcement of its procedural rules contained in 29 CFR 1911.11 is necessary for an expeditious and orderly proceeding. Therefore, the notices of intent to appear will be scrutinized closely for sufficiently detailed information concerning the position to be taken with regard to the issues specified and the evidence to be adduced in support of the position. Persons filing notices of intent to appear which are not sufficiently detailed will be so informed and given fifteen (15) days from the date they are so informed to file a proper notice of intent to appear. In addition, the amount of time requested for each presentation will be reivewed in light of the contents of the notice of intention to appear. In those cases where the information contained in the notice of intention to appear does not seem to warrant the amount of time requested, the participant will be allocated a more appropriate amount of time and notified of this fact. The participant will have fifteen (15) days from the date on which he is so informed to demonstrate why the allocated time is inappropriate.

The hearing will commence at 9:30 a.m. with the establishment of the order for the presentation of statements and the resolution of any other procedural matters relating to the proceeding. The hearing will be conducted, and the decisions made, in accordance with 29 CFR Part 1911.

The oral proceedings will be reported verbatim and a transcript will be made available for inspection and copying to interested persons. Prepared statements and documents that are intended to be submitted for the record at the hearing shall be submitted in quadruplicate before such testimony is presented.

The Administrative Law Judge who will be designated to preside at the hearing shall have all the powers necessary or appropriate to conduct a fair and full informal hearing, including the powers;

(1) To regulate the course of the proceedings;

(2) To dispose of procedural requests, objections, and comparable matters;

(3) To confine the presentations to matters pertinent to the proposed standard;

(4) To regulate the conduct of those present at the hearing by appropriate means;

(5) In his discretion, to question and permit questioning of any witness; and

(6) In his discretion, to keep the record open for a reasonable, stated time to receive written information and additional data, views, and arguments from any person who has participated in the oral proceedings.

Following the close of the hearing, the presiding Administrative Law Judge shall certify the record thereof to the Secretary of Labor. The proposal will be reviewed in light of all oral and written submissions received as part of the record in this and related proceedings, and appropriate action will be taken.

Accordingly, pursuant to sections 6(b) and 8(c)(3) of the Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1599; 29 U.S.C. 655, 657) and 29 CFR Part 1911, it is hereby proposed to amend Part 1910 of Title 29, Code of Federal Regulations by adding a new § 1910.1029 as set forth below.

§ 1910.1029 Coke oven emissions.

(a) *Scope and application.* This section applies to the control of employee exposure to the emissions present during the destructive distillation of coal for the production of coke, except that this section will not apply to working conditions with regard to which other Federal agencies have exercised statutory authority to prescribe or enforce standards or regulations affecting occupational safety and health.

(b) *Definitions.* For the purpose of this section:

"Authorized person" means any person authorized by the employer to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the opportunity to observe monitoring and measuring procedures under paragraph (n) of this section.

"Beehive oven" means a coke oven in which the products of distillation other than coke are not recovered, but are released into the ambient air.

"Coke oven" means a retort in which coke is produced by the destructive distillation of coal.

"Coke oven battery" means a structure consisting of a number of slot-type coke ovens supported on each end by a retaining wall, usually called a pinion wall.

"Coke oven emissions" means respirable particulate matter present in the work environment during the destructive distillation of coal for the production of coke.

"Director" means the Director, National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health, Education and Welfare, or his designee.

"Emergency" means any occurrence such as, but not limited to, equipment failure, or failure of control equipment which is likely to, or does, result in an unexpected exposure to coke oven emissions in excess of the permissible limit. "Respirable particulates" means particulate matter collected by the use of a Dorr-Oliver cyclone or equivalent.

"Secretary" means the Secretary of Labor, U.S. Department of Labor, or his designee.

(c) *Permissible exposure limit.* No employee may be exposed to coke oven emissions in excess of 0.3 milligrams per cubic meter of air (0.3 mg/m³), as determined on an 8-hour time-weighted average based on a 40-hour week.

(d) *Regulated area.* (1) *Requirement.* Regulated areas shall be established and access to them shall be limited to authorized persons.

(2) *Establishment.* The following shall be established as regulated areas:

(i) The coke oven battery including topside and its machinery, pushside and its machinery, coke side and its machinery, and the wharf;

(ii) The beehive oven(s) and machinery; and

(iii) Any other coke plant work area where the permissible exposure limit is exceeded.

(3) *Roster.* A daily roster shall be made of all persons who enter a regulated area.

(e) *Exposure monitoring and measurement.* (1) *Initial monitoring.* Each employer who has a place of employment in which coke oven emissions are present shall monitor each such workplace and work operation to accurately measure if any employee may be exposed without regard to the use of respirators, to coke oven emissions above the permissible exposure limit. Such a determination shall be made by monitoring which is representative of each employee's exposure to coke oven emissions over an 8-hour period.

(2) *Measurements below the permissible limit.* If the measurements under paragraph (e) (1) of this section reveal employee exposure, without regard to the use of respirators, to be below the permissible exposure limit, the employer shall repeat the measurements for each employee at least quarterly.

(3) *Measurements above the permissible limit.* Where an employee is exposed to coke oven emissions in excess of the permissible exposure limit, the measurements required under paragraph (e) (1) of this section shall be repeated at least monthly. The employer shall continue measurements under this section until at least two consecutive measurements are below the permissible exposure limit and then paragraph (e) (2) shall apply.

(4) *Benzo(a)pyrene analysis.* At least every six months, the samples required under paragraph (e) (2) and (3) of this section shall be analyzed for benzo(a) pyrene content.

(5) *Redetermination.* Whenever there has been a production, process, or control change which may result in new or additional exposures to coke oven emissions, or whenever the employer has any other reason to suspect a change in exposure conditions, a new determination of the regulated areas shall be made in accordance with paragraph (e) (1) of this section.

(6) *Employee notification.* (i) Within five (5) working days after the receipt of the measurement results, the employer shall notify each employee in writing of the results of that employee's measurement. Such notification need not be given more frequently than once monthly on the basis of measurements made pursuant to paragraphs (e) (2) and (3) of this section.

(ii) Where the results reveal the employee's exposure to be over the permissible exposure limit, such notification shall also include the corrective action being taken to reduce exposure to or below the permissible exposure limit.

(7) *Accuracy of measurement.* The method of monitoring and measurement shall have an accuracy (with a confidence limit of 95%) of not less than plus or minus 25% for airborne concentrations of coke oven emissions greater than or equal to 0.3 mg/m³.

(f) *Methods of compliance.* Employee exposure to coke oven emissions shall be controlled to or below the permissible exposure limit by engineering controls, work practices, and personal protection controls as follows:

(1) *Engineering and work practice controls.* Engineering controls shall be instituted immediately to reduce exposures to or below the permissible exposure limit, except to the extent that such controls are not feasible. Where engineering controls which can be instituted are not sufficient to reduce exposures to or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by the use of work practice controls. (Appendix B contains a list of some of the engineering and work practice controls available to reduce employee exposure to coke oven emissions.)

(2) *Personal protection controls.* Where engineering and work practice controls are not sufficient to reduce exposures to or below the permissible exposure limit, they shall nonetheless be used to reduce exposure to the lowest possible level, and shall be supplemented by the use of respirators, in accordance with paragraph (g) of this section.

(3) *Mechanical ventilation.* When mechanical ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system to control the exposure, such as capture velocity, duct velocity, or static pressure, shall be made at least every 3 months. Measurements of the system's effectiveness to control exposure shall also be made within 5 days of any change in production, process, or control which might result in any change in employee exposure to coke oven emissions.

(4) *Compliance program.* (i) Each employer shall establish and implement a written program to reduce exposures to or below the permissible exposure limit solely by means of engineering and work practice controls.

(ii) The written program shall include at least the following:

(a) A description of each coke oven operation e.g., crew size, coking time, operating procedures and maintenance practices;

(b) Engineering plans and studies used to determine the controls for the coke oven(s);

(c) A report of the technology considered in meeting the permissible exposure limit;

(d) Monitoring data;

(e) A detailed schedule for implementation of the engineering controls and work practices that cannot be implemented immediately as well as for the development and implementation of any additional engineering and work practices necessary to meet the permissible exposure limit; and

(f) Other relevant information.

(iii) Written plans for such a program shall be submitted upon request by the Secretary and the Director and shall be available at the worksite for examination and copying by the Secretary, Director and the authorized employee representative. Such plans shall be revised and updated at least every six months to reflect the current status of the program.

(g) *Respiratory protection.* (1) *Use.* Respirators shall be used where required under this section. Compliance with the permissible exposure limit may not be achieved by the use of respirators except:

(i) During the time period necessary to install engineering or work practice controls; or

(ii) In work operations such as maintenance and repair activites in which engineering controls are not feasible; or

(iii) In work situations in which engineering controls and supplemental work practice controls are insufficient to reduce exposure to or below the permissible exposure limit; or

(iv) In emergencies.

(2) *Selection.* (i) Where respirators are required under this section the employer shall select and provide the appropriate respirator from the list below and shall assure the employee uses the respirator provided.

RESPIRATORY PROTECTION FOR COKE OVEN EMISSIONS

1. Air-purifying respirator equipped with high efficiency particulate filter.
2. Powered air-purifying respirator equipped with high efficiency particulate filter.
3. Type C, positive pressure supplied-air respirators.

NOTE: High-efficiency particulate filter means 99.97 percent efficient against 0.3 micron particles.

(ii) Respirators shall be selected from those approved by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(3) *Respirator program.* (i) Respirators shall be used and maintained in accordance with § 1910.134 (e) and (f) of this part.

(ii) The employer shall institute a respiratory protection program in accordance with § 1910.134(b) of this part.

(iii) Employees who wear respirators shall be allowed to leave work areas to wash their face and respirator facepiece to prevent skin irritation associated with respirator use.

(h) *Protective clothing and equipment.* (1) *Provision and use.* (i) Where the possibility of repeated skin contact with coke oven emissions exists or where the employee may be exposed to the heat generated by the coke oven, the employer shall provide and assure that employees use appropriate clean protective clothing and equipment such as, but not limited to:

(*a*) Water-proof and flame and heat resistant full body covering;

(*b*) Face shields or vented goggles, complying with the requirements of § 1910.133(a)(2)–(a)(6) of this part including those appropriate for protecting against heat and for protecting the eyes when directly viewing incandescent coke;

(*c*) Fire resistant gloves;

(*d*) Safety shoes complying with the requirements of § 1910.136 of this part insulated from hot surfaces; and

(e) Protective helmets complying with the requirements of § 1910.135 of this part.

(ii) Such protective clothing and equipment shall prevent contamination of the employee's street clothing and shall prevent skin contact with coke oven emissions.

(iii) Clean and dry protective clothing and equipment shall be provided to each affected employee at least daily.

(2) *Cleaning.* (i) The employer shall clean, launder, maintain, or dispose of protective clothing and equipment required by this section.

(ii) The employer shall assure that all protective clothing and equipment is removed only in change rooms as prescribed in paragraph (i)(1) of this section and shall assure that contaminated protective clothing and equipment is removed from the facility only in accordance with paragraph (h)(2)(iii) of this section.

(iii) The employer shall assure that no employee removes contaminated protective clothing and equipment from the change room except for those employees authorized to do so for the purpose of cleaning, laundering, maintenance, or disposal.

(iv) Contaminated protective clothing and equipment shall be placed in impermeable closed containers.

(v) The employer shall inform any person who launders or cleans protective clothing and equipment required by this section, of the potentially harmful effects of exposure to coke oven emissions.

(i) *Hygiene facilities and practices.* (1) *Change rooms.* Where employees wear protective clothing and equipment, clean change rooms equipped with storage facilities for street clothes and separate storage facilities for protective clothing shall be provided.

(2) *Showers.* Employees working in regulated areas shall be required to shower before leaving at the end of the work shift. The employer shall provide shower facilities in accordance with § 1910.141(d)(3) of this part.

(3) *Lavatories.* Employees working in regulated areas shall be required to wash hands, face, and forearms prior to drinking, eating, smoking, or applying cosmetics. The employer shall provide an adequate number of lavatories for this purpose which shall meet the requirements of § 1910.141(d)(2) of this part.

(4) *Arrangement of shower facilities.* Clothes locker and shower facilities shall be so arranged that the showers serve to demarcate between potentially contaminated and uncontaminated areas.

(5) *Arrangement of lavatory facilities.* Lavatory and toilet facilities which are located in coke oven emission-contaminated areas shall be so arranged that no access is available to an uncontaminated area.

(6) *Lunchroom.* Lunchroom facilities shall be provided and shall have a temperature controlled, positive pressure, filtered air supply.

(7) *Prohibition of activities in regulated areas.* The presence or consumption of food or beverages, the presence or use of smoking or nonfood chewing products, and the presence or application of cosmetics shall be prohibited in regulated areas.

(j) *Medical surveillance.* (1) *General requirements.* (i) Each employer shall institute a medical surveillance program for all employees who work in regulated areas at least 30 days per year.

(ii) The program shall provide each employee covered under paragraph (j)(1)(i) of this section with an opportunity for medical examinations in accordance with this paragraph.

(iii) If any employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risk involved in the refusal to be examined.

(iv) All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided during the employee's normal working hours, without cost to the employee.

(2) *Initial examinations.* At the time of initial assignment to a regulated area, subject to paragraph (j)(1)(i) of this section, or upon institution of the medical surveillance program, the following shall be performed by a person specified in paragraph (j)(2)(iv) of this section.

(i) A work history and a comprehensive medical history which shall include the presence and degree of respiratory symptoms, i.e. breathlessness, cough, sputum production and wheezing; and

(ii) A medical examination which shall include as a minimum the following:

(*a*) A 14" by 17" posterior-anterior chest x-ray and UICC classification;

(*b*) Pulmonary function tests to include forced vital capacity (FVC) with recording of the equipment used;

(*c*) Baseline weight;

(*d*) A skin examination;

(*e*) Urinalysis for sugar, albumin, and hematuria;

(*f*) A urinary cytology examination (for employees having 5 or more years employment in coke ovens or who are 40 years of age or older); and

(*g*) A sputum cytology examination (for employees having 10 or more years employment in coke ovens or who are 45 years of age or older).

(3) *Periodic examinations.* (i) Examinations specified in paragraph (j)(2) of this section shall be performed at least annually for employees covered under paragraph (j)(1)(i) of this section, and semi-annually for employees 45 years of age or older or with 10 or more years employment in coke oven.

(ii) When an employee otherwise covered by this paragraph transfers or is transferred from employment in a regulated area, the examinations specified in paragraph (j)(2) of this section shall be continued as long as that employee is employed by the same employer or a successor employer.

(iii) If an employee has not had the examinations specified in paragraph (j)(2) of this section within 3 months of the termination of employment, the employer shall make such examinations available to the employee.

(4) *Alternative medical examinations.* If the examining physician determines that medical examinations alternative to those specified in paragraph (j)(2) of this section will provide at least equal assurance of detecting medical conditions pertinent to protecting the employee from the health hazards associated with exposure to coke oven emissions, the employer may accept such alternative medical surveillance examinations as meeting the requirement of this section, provided that the employer:

(i) Obtains a statement from the examining physician setting forth the alternative medical examinations and the rationale for their substitution and submits such statement to the Secretary; and

(ii) Informs each employee of the fact that medical examinations alternative to those required by paragraph (j)(2) of this section are to be made available.

(5) *Information provided to the physician.* The employer shall provide the following information to the examining physician.

(i) A copy of this regulation for coke oven emissions including Appendixes A and B;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The results of the employee's exposure measurement, if available;

(iv) A description of any personal protective equipment used, or to be used;

(v) The employee's anticipated or estimated exposure level and;

(vi) Upon request of the physician, information from previous medical examination of the affected employee.

(6) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician, containing the following:

(*a*) The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from exposure to coke oven emissions, or which would directly or indirectly aggravate any detected medical condition;

(*b*) Any recommended limitations upon the employee's exposure to coke oven emissions and upon the use of protective clothing and equipment such as respirators; and

(*c*) A statement that the employee has been informed by the physician of any medical conditions which require further examination or treatment.

(ii) The written opinion shall not reveal specific findings or diagnoses unrelated to occupational exposure.

(iii) A copy of the written opinion shall be provided to the affected employee.

(7) *Withdrawal from exposure.* No employee shall be exposed to coke oven emissions in such a way as would put the employee at increased risk of material impairment of his or her health from such exposure. This determination may be based on the physician's written opinion.

(k) *Employee information and training.* (1) *Training program.* (i) The employer shall provide a training program for employees assigned to regulated areas.

(ii) The training program shall be provided at the time of initial assignment, and at least annually thereafter, and shall include informing each employee of:

(*a*) The information contained in the substance information sheet for coke oven emissions (Appendix A);

(*b*) The specific nature of operations which could result in exposure to coke oven emissions as well as any necessary protective steps;

(*c*) The engineering controls and work practices associated with that employee's job assignment;

(*d*) The purpose, proper use, and limitations of respiratory protection devices as specified in § 1910.134 (b), (e), and (f) of this part;

(*e*) The purpose for and a description of the medical surveillance program as required by paragraph (j) of this section; and

(*f*) A review of this standard.

(2) *Access to training materials.* (i) A copy of this standard and its appendixes shall be made readily available to all employees working in regulated areas.

(ii) All materials relating to the employee information and training program shall be provided upon request to the Secretary and the Director.

(l) *Precautionary labels and signs.* (1) *General.* (i) Labels or signs required by other statutes, regulations or ordinances may be used in addition to, or in combination with, labels or signs required by this paragraph.

(ii) No statement shall appear on or near any required sign, label or instruction required by this paragraph which contradicts or detracts from the effect of the required sign, label or instruction.

(2) *Labels.* Precautionary labels shall be applied to all containers of protective clothing or equipment contaminated with coke oven emissions. The labels shall read as follows:

DANGER

CANCER HAZARD

CONTAMINATED WITH COKE OVEN EMISSIONS

DO NOT REMOVE DUST BY BLOWING OR SHAKING

(3) Regulated areas shall be posted with signs bearing the legend:

DANGER

CANCER HAZARD

AUTHORIZED PERSONNEL ONLY

NO SMOKING

(ii) Areas where the permissible exposure limit is exceeded shall be posted with signs bearing the legend:

DANGER

CANCER HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATOR REQUIRED

(iii) Signs required by this paragraph shall be illuminated during non-daylight hours and cleaned regularly so that the legend is clearly visible to employees.

(m) *Recordkeeping.* (1) *Exposure measurements.* The employer shall keep an accurate record of all measurements taken to monitor employee exposure to coke oven emissions required in paragraph (e) of this section.

(i) This record shall include:

(*a*) The date of measurement;

(*b*) The operation involving exposure to coke oven emissions which is being monitored;

(*c*) Sampling and analytical methods used and evidence of their accuracy;

(*d*) Number, duration, and results of samples taken;

(*e*) Type of protective devices worn, if any;

(*f*) Name, social security number, job title, and exposure of the employee monitored; and

(*g*) The environmental variables that could affect employee exposure.

(ii) This record shall be maintained for at least 40 years or for the duration of employment plus 20 years, whichever is longer.

(2) *Mechanical ventilation measurements.* When mechanical ventilation is used as an engineering control, the employer shall maintain a record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (f) (3) of this section.

(i) This record shall include:

(*a*) Date and location of measurement;

(*b*) Type of measurement taken; and

(*c*) Result of measurement;

(ii) This record shall be maintained for at least two years.

(3) *Employee training.* The employer shall keep an accurate record of all employee training required by paragraph (k) of this section.

(i) This record shall include:

(*a*) Date of training;

(*b*) Name, social security number and job title of employee trained;

(*c*) Content or scope of training provided; and

(*d*) Identification of materials distributed to the employee.

(ii) This record shall be maintained for at least 2 years.

(4) *Medical surveillance.* The employer shall keep an accurate medical record for each employee subject to medical surveillance as required by paragraph (j) of this section.

(i) The record shall include:

(*a*) The physician's written opinion;

(*b*) Any employee medical complaints related to exposure to coke oven emissions;

(*c*) A copy of the information provided to the physician as required by paragraph (j) (5) of this section; and

(*d*) A signed statement of each refusal of medical examination, if any.

(ii) This record shall be maintained for at least 40 years, or for the duration of employment plus 20 years, whichever is longer.

(5) *Rosters.* Authorized personnel rosters required by pargraph (d) (3) of this section shall be maintained for at least 40 years or for the duration of employment plus 20 years, whichever is longer.

(6) *Availability.* (i) All records required to be maintained by this section shall be made available upon request to the Secretary and the Director for examination and copying.

(ii) Records of employee exposure measurements required by paragraph (m) (1) of this section shall be made available for examination and copying to employees, former employees, and their designated representatives.

(iii) Employee medical records required to be maintained by paragraph (m) (4) of this section shall be made available upon request for examination and copying to a physician designated by the affected employee or former employee.

(7) *Transfer of records.* (i) In the event the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section.

(ii) In the event the employer ceases to do business and there is no successor to receive and retain the records for the prescribed period, these records shall be transmitted by registered mail to the Director, and each employee and former employee shall be individually notified in writing of this transfer.

(n) *Observation of monitoring.* (1) *Employee observation.* The employer shall give employees or their representatives an opportunity to observe any measuring or monitoring of their exposure to coke oven emissions conducted pursuant to this section.

(2) *Observation procedures.* (i) When observation of the measuring or monitoring of employee exposure to coke oven emissions requires entry into an area where the use of personal protective devices is required, the observer shall be provided with and required to use such equipment and shall comply with all other applicable safety and health procedures.

(ii) Without interfering with the measurement, observers shall be entitled to:

(*a*) Receive an explanation of the measurement procedures;

(*b*) Observe all steps related to the measurement of coke oven emissions performed at the place of exposure; and

(*c*) Record the results obtained.

(o) *Effective date.* This standard shall become effective 30 days following publication of the final standard in the FEDERAL REGISTER.

(p) *Startup dates.* (1) *Exposure measurement.* Measurements prescribed in paragraph (e) of this section shall be instituted within 2 months of the promulgation of the final standard, except that for new production areas or operations such determinations and measurements shall be instituted within 30 days of startup of operation.

(2) *Medical surveillance.* Medical surveillance prescribed in paragraph (j) of this section shall be instituted within 3 months of the promulgation of the final standard.

(3) *Compliance program.* The written program required by paragraph (f) (4) shall be available for inspection within 2 months after the completion of the initial monitoring required by paragraph (e) (1).

(q) *Appendixes.* The information contained in the appendixes to this section is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

APPENDIX A

COKE OVEN EMISSIONS
SUBSTANCE INFORMATION SHEET

I. Substance identification.

A. *Substance:* Coke oven emissions.

B. *Definition:* Respirable particulate matter present in the work environment during the process of destructive distillation of coal for the production of coke.

C. *Permissible exposure limit:* 0.3 milligrams per cubic meter of air as determined on an 8-hour time-weighted average for a 40-hour week.

D. *Regulated areas:* Only employees authorized by your employer should enter a regulated area. The employer is required to designate the following areas as regulated areas: the coke oven battery, including topside and its machinery, pushside and its machinery, coke side and its machinery, and the wharf; the beehive ovens and machinery; and any other work areas where exposure to coke oven emissions is above the permissible limit.

II. Health hazard data.

Exposure to coke oven emissions is believed to be a cause of lung cancer, and possibly kidney cancer, in humans. Although it has not been shown to produce skin cancer in humans, repeated skin contact with coke oven emissions should be avoided.

III. Protective clothing and equipment.

A. *Respirators:* You can only be required to wear a respirator for routine use if your employer is in the process of installing engineering controls or where engineering and work practice controls are not feasible or are insufficient. You must wear respirators for non-routine activities or in emergency situations where you are likely to be exposed to levels of coke oven emissions in excess of the permissible exposure limit. The respirators you wear must have a label of approval from the National Institute for Occupational Safety and Health. If you experience difficulty in breathing while wearing a respirator, tell your employer.

B. *Protective clothing:* Your employer is required to provide, and you must wear, appropriate, clean, protective clothing and equipment to protect your body from repeated skin contact with coke oven emissions and from the heat generated during the coking process. This clothing should include such items as water-proof and flame and heat resistant full body coverings; face shields or vented goggles appropriate for protecting your eyes and face against heat and direct viewing of glowing coke; fire resistant gloves; heat insulated safety shoes; and protective helmets.

IV. Hygiene facilities and practices.

You must not eat, drink, smoke, chew gum or tobacco, or apply cosmetics in the regulated area. Your employer is required to provide lunchrooms and other areas for these purposes.

Your employer is required to provide showers, washing facilities, and change rooms. If you work in a regulated area, you must wash your face, hands and forearms before eating, drinking, smoking or applying cosmetics. You must shower at the end of your work shift. Do not take used protective clothing or equipment out of the change rooms without your employer's permission. Your employer is required to provide for laundering or cleaning of your protective clothing and equipment.

V. Signs and labels.

Your employer is required to post warning signs and labels for your protection. Labels are to be applied to containers of used protective clothing and equipment which are contaminated with coke oven emissions. These labels warn against skin contact and against removing dust from the clothing by blowing or shaking. Signs must be posted at the entrances to regulated areas. The signs should warn that a cancer hazard is present, that only authorized employees may enter the area, and that no smoking is allowed. In regulated areas where coke oven emissions are above the permissible exposure limit, the signs should also warn that respirators must be worn.

VI. Medical examinations.

If you work in a regulated area at least 30 days per year, your employer is required to provide you with a medical examination every year. The medical examination must include a chest x-ray; pulmonary function tests; weight comparison; skin examination; and a urinalysis. In addition, a urinary cytology examination must be made if you have worked in coke oven area for 5 or more years or if you are 40 or more years old. These examinations plus a sputum cytology examination must be made semi-annually if you have worked in the coke oven for 10 or more years, or are 45 years of age or older.

VII. Observation of monitoring.

Your employer is required to monitor your exposure to coke oven emissions and you are entitled to observe the monitoring procedure. You are entitled to receive an explanation of the measurement procedure, observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you must also be provided with and must wear the protective clothing and equipment.

VIII. Access to records.

You or your representative are entitled to see the records of measurements of your exposure to coke oven emissions upon request to your employer. Your medical examination records can be furnished to your physician upon request to your employer.

APPENDIX B

COKE OVEN EMISSIONS, ENGINEERING AND WORK PRACTICE

Control Guidelines

I. *Engineering controls.*

The following are some of the engineering controls available to control coke oven emissions:

A. *Charging emission controls.*

1. Stage or sequential charging or a closed charging system.

2. Double collector mains, or a jumper pipe system either fixed or movable, linking the oven to be charged to an adjacent oven.

3. Steam jets of sufficient diameter and pressure to move the gases evolved during charging into the collector main or mains.

4. Air seals around the leveler bar on pusher machines.

5. Charging hole frames properly aligned to match the drop sleeves on the larry car.

6. Individually operated larry car drop sleeves.

7. Mechanized gooseneck and standpipe cleaners.

8. Decarbonizing air compressor system and a carbon cutter on the pushing rams.

9. Mechanical lid lifters.

10. Mechanical volumetric controls on each larry car hopper to properly predetermine the amount of coal charged through each charging hole.

B. *Coking emission controls.*

1. Gas collector main pressure control on each battery.

2. Door repair shops capable of prompt and efficient repair and/or replacement of coke oven doors and seals.

3. A gasket on each chuck door or oven door which has leaked until or unless such chuck door or oven door is replaced with a new or repaired chuck door or oven door.

4. High pressure water systems or other appropriate equipment for use in cleaning oven doors and jambs.

5. Heat shields on pusher and coke side door machines.

6. Hoppers on pusher and coke side door machines.

7. Automatic door and jamb cleaning equipment.

8. Goosenecks that utilize automatic cleaning equipment.

9. Remote controlled dampering-off systems.

C. *Additional engineering equipment.*

Coke battery machinery cabs equipped with temperature controlled filtered air, and standby pulpits for topside and other areas with the same type of air control.

D. *Applicability of engineering controls.*

In some cases, the engineering controls in this Appendix may only be applicable to new coke oven batteries or to rehabilitated batteries that are essentially rebuilt. These batteries should contain the best available equipment and control devices which should not be less than those applicable to existing batteries.

II. Work practice controls.

The following are some work practice controls available to control coke oven emissions. The applicability may vary depending on the nature of the charging system i.e. open or closed.

A. *Maintenance and repair.*

1. Inspect goosenecks, standpipes, and charging hole lids for cracks, warpage, misalignment, and other defects and make the necessary repairs.

2. Remove tar and carbon buildup from goosenecks and standpipes to at least the minimum necessary diameter.

3. Remove roof carbon buildup to provide an adequate gas channel at the top of the oven.

4. Clean and inspect liquor sprays to assure adequate flushing liquor at all times.

5. Inspect aspiration system to assure optimum pressure.

6. Clean steam nozzles regularly.

7. Apply luting material to seal standpipes where necessary.

8. Fill larry car hoppers with to a predetermined level established for each hopper by mechanical volumetric controls.

9. Align the larry car so that the drop sleeves fit tightly over the charging holes.

10. Repair any cracks or defects in the brickwork and collector main.

B. *Procedures during charging.*

1. Carry out charging in accordance with a specific written procedure to minimize coke oven emissions.

2. Turn off the aspiration system only after the charging hole lids have been replaced and sealed.

C. *Proper heating practices.*

1. Heat the coal charge uniformly for a sufficient period to insure proper coking.

2. Repair or replace defective heating equipment.

3. Establish procedures for checking the oven back pressure controls to maintain uniform pressure conditions in the collecting main.

D. *Pushing of coke.*

1. Establish procedures for dampering off the ovens at the end of the coking cycle and removal of the charging lids.

2. Coke should not be pushed unless it is thoroughly "coked out."

3. Coke and coal spillage on benches should not be shoveled into a heated oven.

E. *Coke oven doors.*

1. Non-luted oven doors, door jambs and chuck doors should be designed, maintained and cleaned so as to provide a continuous metal-to-metal fit of the sealing edges to the jambs, or the sealing edges of doors and chuck doors shall be covered with gasket material to accomplish such continuous metal-to-metal fit.

2. All coke oven doors, chuck doors and jambs should be cleaned thoroughly before or after every push.

3. Oven doors which continue to leak should be replaced with spare oven doors which are new or have been properly repaired.

4. An adequate number of new or repaired doors should be available.

5. Doors which have been luted should be reluted to stop leakage and replaced where necessary.

6. When a replacement door is to be placed on an oven, it should be heated in such a way as to conform to the thermal warpage of the door jambs before being placed on the oven; it should then be adjusted both immediately before and after the first charge.

F. *Coke battery maintenance.*

Written maintenance procedures and schedules should be developed to:

1. Preserve alignments of charging hole castings and larry car drop sleeves;

2. Preserve alignments of off-take equipment;

3. Prevent miscellaneous fugitive topside emissions;

4. Provide an effective oven patching program;

5. Maintain and repair coke oven doors, door jambs, and seals;

6. Maintain battery machinery in good working order.

(Secs. 6, 8, 84 Stat. 1593, 1599, (29 U.S.C. 655, 657, and 29 CFR Part 1911))

[FR Doc.75-19869 Filed 7-30-75;8:45 am]